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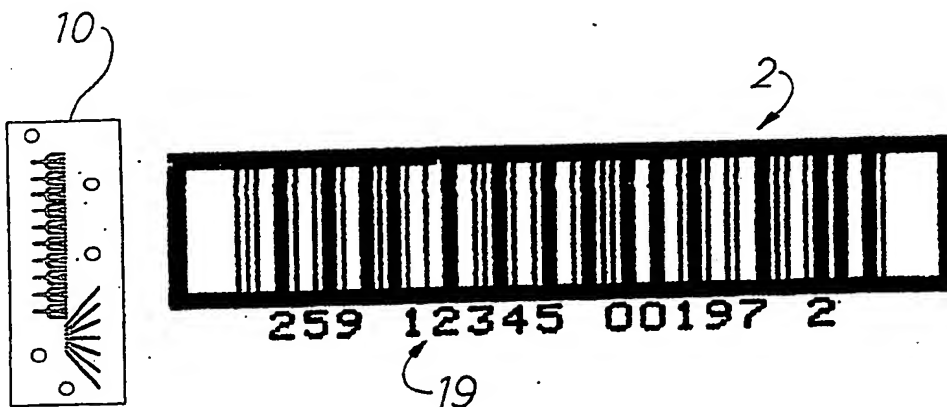
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(54) Title: **AN ARRANGEMENT IN FLUID JET PRINTERS**



(57) Abstract

An arrangement in fluid jet printers for ejection of a fluid in the form of droplets on a recording medium so as to generate characters thereon, such as bar codes (2), comprises a housing wall in which are formed a number of holes for reception in each one thereof of a valve body, a valve plate connected to the housing wall and formed with fluid passageway apertures in front of and in alignment with the valve bodies, said valve bodies sealingly cooperating with valve seats surrounding the apertures, and a nozzle plate (10) connected to the valve plate and provided with fluid channels the ends of which are positioned in front of the fluid passageway apertures, some of said fluid channels being branched off so as to form branch channels, the free ends of which are connected to jet nozzles directed towards the recording medium.

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AN ARRANGEMENT IN FLUID JET PRINTERS

This invention concerns an arrangement in fluid jet printers for ejection of a fluid in the form of droplets on a recording medium to generate characters thereon, said printer comprising a housing with a wall in which are formed a plurality of through holes in each one of which is received a preferably electro-magnetically operated valve body, a valve plate which is connected to the housing wall and which is formed with fluid passage-way apertures positioned in front of and in alignment with the respective valve bodies, each aperture having a valve seat sealingly cooperating with its associated valve body, and a nozzle plate interconnected with the valve plate on the valve plate face turned away from the housing wall, said nozzle plate formed with fluid channels having one of their ends positioned in alignment with the fluid passageway apertures whereas their opposite ends communicate with jet nozzles, said nozzles being directed towards the recording medium.

In using fluid jet printers of this type to generate large characters, i.e. characters having a height of approximately 30 mm and more, on a recording medium the vertical spacing between the dots formed by the fluid droplets into the characters will be so large that the gaps between the dots become very obvious.

In some applications this is of no great significance but in other applications it constitutes a serious drawback.

For instance, in printing e.g. bar codes consisting of straight lines or bars of different widths enclosed by a rectangular frame and having the character height indicated above, the gaps between the dots forming the bars and the frame may result in coding errors in the equipment designed to read and/or record/convert the

code, with obvious consequential risks.

In some cases, large letters and numbers are disadvantageous because of the difficulties that they present both to the eye and to the reading equipment as regards  
5 reading and interpret action, which is due precisely to the obvious gaps between the dots.

The purpose of the subject invention is to indicate an arrangement in fluid jet printers of the kind outlined initially, by means of which it becomes possible  
10 to generate characters, i.e. letters, numbers, bar codes and the like, having a higher degree of homogeneity and without disturbing gaps between the dots, resulting in a considerably safer and clearer reading and/or decoding of the characters.

15 This purpose is achieved in accordance with the invention in that at least some of the fluid channels are branched off so as to form branch channels, each one of which communicates with its respective jet nozzle. Consequently, fluid supplied to each such branched off  
20 fluid channel will be discharged simultaneously from all jet nozzles connected thereto. Preferably, these jet nozzles are positioned in a row in a closely juxtaposed relationship.

Owing to this arrangement the gaps between the  
25 dots in each character will be greatly reduced or non-existent, with the result that the characters will appear as completely homogeneous.

The invention will be described in the following with reference to the accompanying drawings which together illustrate a presently particularly preferred  
30 embodiment. In the drawings:

Fig. 1 shows in a laterally perspective view a fluid jet printer of the type referred to, wherein the components incorporated in the printer are shown in  
35 a disassembled position and in some case only partially.

Fig. 2 is a view from above, the left part of which illustrates a nozzle plate incorporated in the fluid

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jet printer in accordance with Fig. 1 and the right hand part of which shows a bar code printed by means of the printer.

Fig. 3 illustrates the nozzle plate in accordance with Fig. 2 on an enlarged scale.

The fluid jet printer illustrated in Fig. 1 and generally indicated by numeral reference 1 is designed to eject a liquid, for instance ink, in droplet form onto a recording medium, not shown, so as to form characters, for instance the bar code 2 illustrated in Fig. 2, on that medium.

In accordance with the embodiment shown the fluid jet printer comprises a housing, not illustrated in any detail, incorporating a bottom wall 3. In the bottom wall 3 are provided a plurality of through holes 4, in the embodiment shown 17 holes, for reception in each one of said holes of a valve body 5 in the shape of a piston. The valve bodies 5 are electro-magnetically operated in a manner known per se to open and close fluid passage way apertures 6. These apertures 6 are positioned in alignment opposite their respective one of the valve bodies and they are formed in a valve plate 7 which is fastened to the housing wall 3, for instance by means of screws. A coating 8 of rubber or similar material is applied on the valve plate 7 and around the fluid passageway apertures 6 it is formed with valve seats 9 which sealingly cooperates with their respective one of the valve bodies 5.

A nozzle plate 10 is joined to the valve plate 7, for instance by means of screws, on the valve plate face which is turned away from the housing wall 3, a packing seal 11 being sandwiched between the plate 7 and the plate 10. As appears also from Figs. 2 and 3 there are provided in the nozzle plate 10, in the side thereof facing the valve plate 7, a number of comparatively shallow fluid channels 13, the first ends 12 of which are positioned in alignment with the fluid passage-

way apertures 6. The fluid channels 13 consequently extend in parallel with the plane of the nozzle plate 10. The opposite channel ends 14 are connected to jet nozzles 15 which are directed towards the recording medium.

More precisely, at least some of the fluid channels 13, in accordance with the shown embodiment 10 out of a total of 17, are branched off into four branch channels 16, each one of which communicates with its respective one of the jet nozzles 15.

The jet nozzles 15 associated with the branch channels 16 are placed very close together in one single row 17 with a spacing in accordance with the embodiment illustrated of approximately 1 mm. The row 17 of branch channels 16 extends transversely to the direction of movement in relation to the recording medium.

Also the branch channels 16 are formed in the side of the nozzle plate 10 that faces the valve plate 7 but are shallower than the branched off fluid channels 13 before the branching off points of the latter. The opposite ends 14 of the branch channels 16 as well as those of the remaining seven fluid channels 13 debouch into fluid discharge apertures 18 which extend through the nozzle plate 10 and in which are mounted the jet nozzles 15.

In accordance with the embodiment illustrated and described the ten branched off fluid channels 13 serve to produce homogeneous, comparatively tall characters 2 as shown in Fig. 2, by way of their branch channels 16 and jet nozzles 15 associated therewith, whereas the remaining seven fluid channels 13 serve to produce the lower characters 19 shown in Fig. 2 by way of their associated jet nozzles 15.

## CLAIMS

1. An arrangement in fluid jet printers (1) for ejection of a fluid in the form of droplets on a recording medium to generate characters (2, 19) thereon, said printer (1) comprising a housing with a wall (3) in which are formed a plurality of through holes (4) in each one of which is received a preferably electro-magnetically operated valve body (5), a valve plate (7) which is connected to the housing wall (3) and which is formed with fluid passageway apertures (6) positioned in front of and in alignment with the respective valve bodies (5), each aperture having a valve seat (9) sealingly cooperating with its associated valve body (5), and a nozzle plate (10) interconnected with the valve plate (7) on the valve plate face turned away from the housing wall (3) said nozzle plate (10) formed with fluid channels (13) having one of their ends (12) positioned in alignment with the fluid passageway apertures (6) whereas their opposite ends (14) communicate with jet nozzles (15), said nozzles being directed towards the recording medium, characterized in that at least some of the fluid channels (13) are branched off so as to form branch channels (16) each one of which communicates with its respective jet nozzle (15).

2. An arrangement as claimed in claim 1, characterized in that the jet nozzles (15) associated with the branch channels (16) are placed closely together in a row (17).

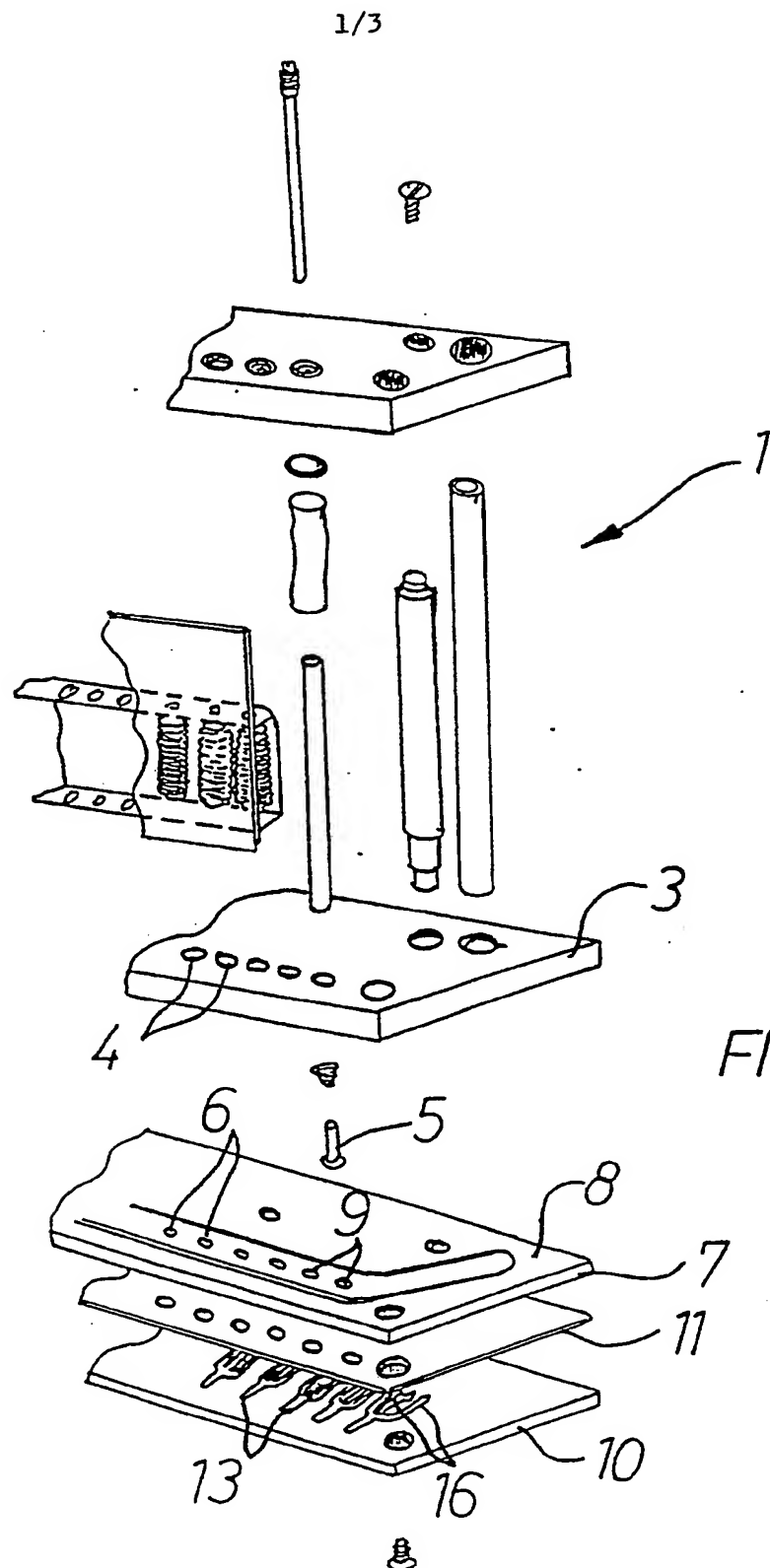
3. An arrangement as claimed in claim 2, characterized in that the fluid channels (13) and the branch channels (16) are formed in the side of the nozzle plate (10) facing the valve plate (7), and in that the opposite ends (14) of the channels (13, 16) open into fluid discharge apertures (18) extending through the nozzle plate, said jet nozzles (15) being

mounted in said fluid discharge apertures (18).

4. An arrangement as claimed in claim 3 c h a -  
r a c t e r i z e d in that the branched off fluid  
channels (13) are deeper upstream of their branching  
5 off points into the branch channels (16).

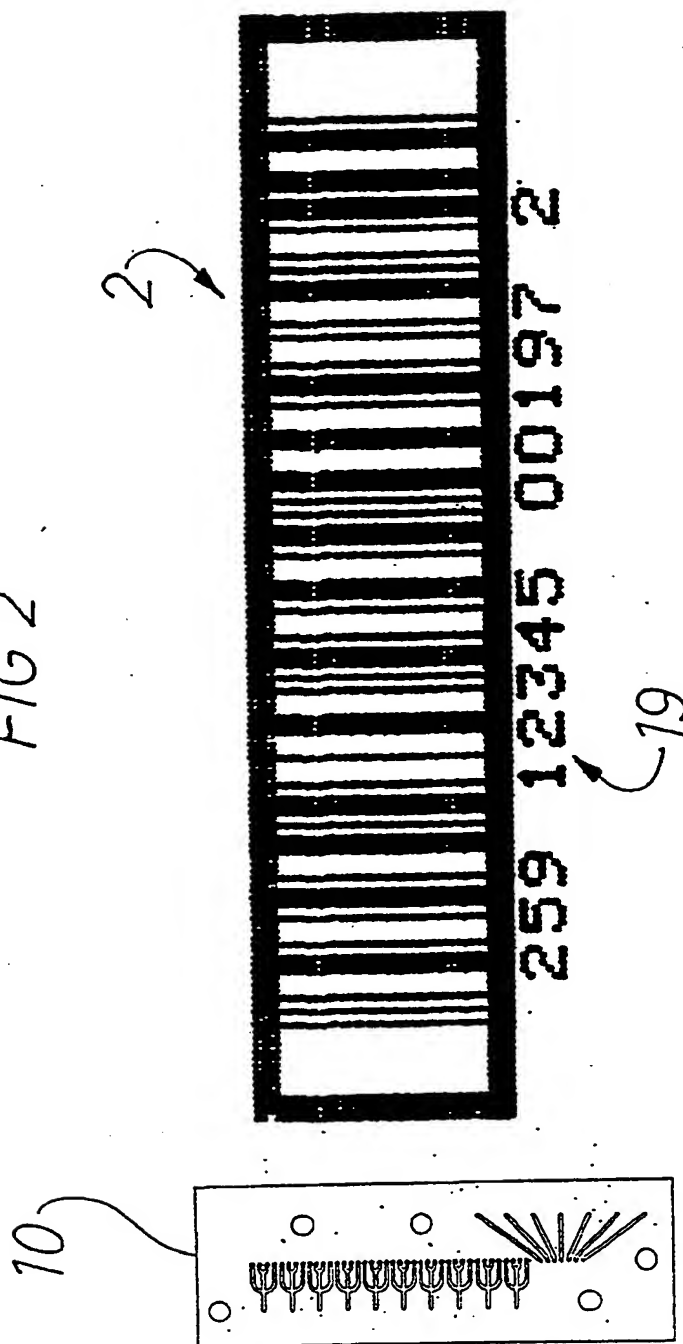
5. An arrangement as claimed in any one of the  
preceding claims, c h a r a c t e r i z e d in that  
the nozzle plate (10) comprises at least seventeen  
fluid channels (13), at least ten of which are branched  
10 off into at least four branch channels (16) each.





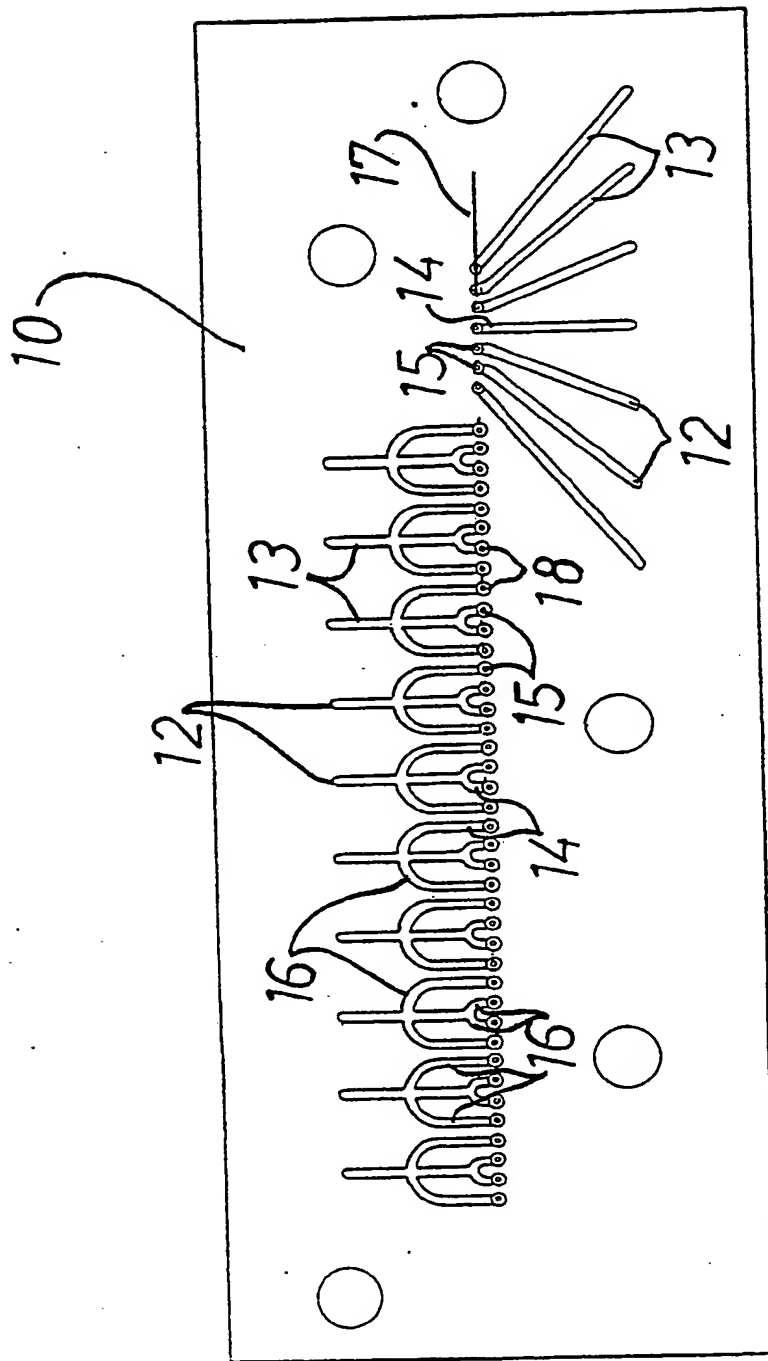
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FIG 2



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FIG3



SUBSTITUTE SHEET

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE 89/00649

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 41 J 2/145		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC5	B 41 J, G 06 K	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
SE, DK, FI, NO classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	SE, B, 456597 (SCANDOT SYSTEM AB) 17 October 1988, see the whole document --	1, 2, 3
Y	SE, B, 456412 (SCANDOT SYSTEM AB) 3 October 1988, see the whole document --	1, 2, 3
Y	US, A, 4396924 (G. ROSENSTOCK) 2 August 1983, see column 3, line 11 - line 30; column 3, line 36 - line 49; figures 1, 2 --	1
Y	EP, A2, 225169 (EXXON PRINTING SYSTEMS INC) 10 June 1987, see column 3, line 11 - line 15; column 3, line 23 - line 29; column 5, line 49 - line 62; figures 2, 3, 11 -- -----	1, 2
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>14</sup> Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search 3rd January 1990		Date of Mailing of this International Search Report 1990 -01- 24
International Searching Authority SWEDISH PATENT OFFICE		Signature of Authorized Officer JAN SILFVERLING

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 89/00649**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-B- 456597	17/10/88	GB-A- 2201229	24/08/88
		FR-A- 2610868	19/08/88
		SE-A- 8700544	13/08/88
		DE-A- 3804092	08/09/88
		JP-A- 63247050	13/10/88
		US-A- 4826135	02/05/89
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SE-B- 456412	03/10/88	WO-A- 88/05726	11/08/88
		SE-A- 8700433	06/08/88
		AU-D- 13472/88	24/08/88
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US-A- 4396924	02/08/83	EP-A- 0030382	17/06/81
		DE-A-C- 2949616	11/06/81
		JP-A- 56093567	29/07/81
		CA-A- 1140390	01/02/83
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EP-A2- 225169	10/06/87	JP-A- 62216753	24/09/87
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